June 30, 1931. A. G. BELDEN ET AL 1,811,873

SPEED CONTROL DEVICE FOR GRINDING MACHINES

Filed June 29, 1929

Fig. 1

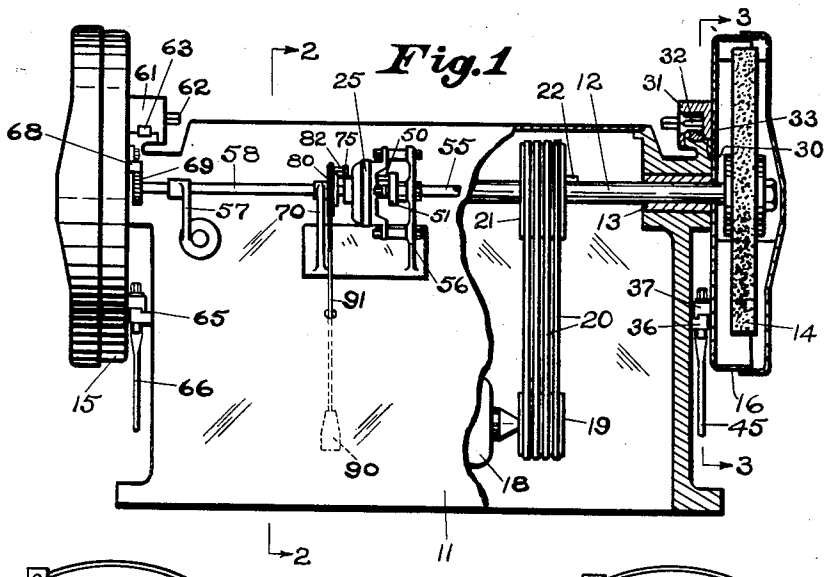


Fig. 3

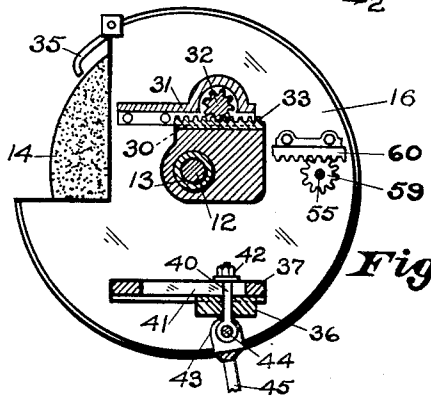


Fig. 2

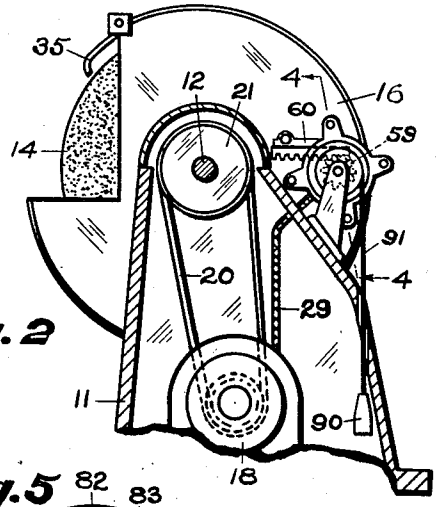


Fig. 4

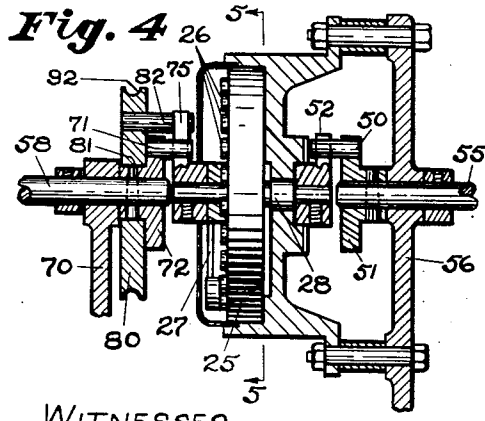
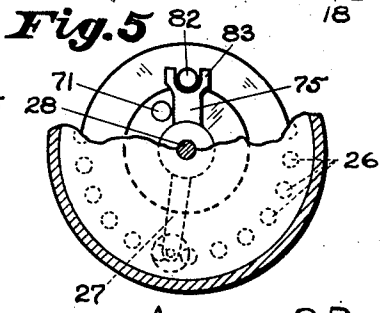


Fig. 5



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Patented June 30, 1931 1,811,873

UNITED STATES PATENT OFFICE

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SPEED CONTROL DEVICE FOR GRINDING MACHINES

Application filed June 29, 1929. Serial No. 374,796.

This invention relates to grinding machines and more particularly to a speed controlling device for the grinding wheels on motor driven floor stands.

In various types of grinding machines, such as floor stands, it is desirable in order to obtain the maximum efficiency of the grinding wheel, that the surface or peripheral speed of the wheel be substantially constant. Floor stands for tool grinding and snagging have been constructed and arranged so that it is possible to change the speed of the wheel from a slow to a fast speed as it wears away. This has usually been accomplished by shifting the driving belt from one cone of a pulley on the spindle to another cone to step up the speed of the pulley or by shifting a rheostat to control the speed of an electric motor which is connected to rotate the spindle.

Grinding wheels are now being successfully produced which are capable of withstanding high speeds of rotation and rapid production. These wheels, however, are of comparatively brittle structure so that it is necessary to guard against rotation at an excessive speed to eliminate the danger of wheel breakage. The operators of such machines have found by experience that a rapidly rotating wheel gives a faster cutting action and, learning this fact, they speed up the wheel as fast as possible to increase their production. Hence it is desirable to provide such a machine with a safety device which prevents the operator from running the wheel at a speed greater than is found by experience to be safe; and in certain types of grinding machines, such as floor stands for snagging rough castings and the like, the speed change mechanism used to permit speeding up of the wheel as it is reduced in diameter should be controlled by a device which prevents the rotative speed of the wheel from being increased until the wheel has worn away a predetermined amount.

This feature is more important today than in the past, due to the development of the high speed wheel. In the past, the wheel structures have permitted rotation of the wheel at a peripheral speed of five to six thousand feet per minute which was considered a comparatively safe speed. Today, with the new wheel development, the modern high speed wheels may be rotated at a peripheral speed of nine thousand feet per minute and upward, depending on the size and type of wheel. It will be readily appreciated that the centrifugal bursting strain of the wheel increases rapidly as the surface speed or R. P. M. is increased and it is highly desirable that a suitable speed control device be provided to prevent rotating the wheel at an excessive speed.

It is accordingly the primary purpose of this invention to provide an electrical control device for regulating the speed of a motor driven grinding wheel, which is so constructed that the movable member of the control device may be freely actuated to run the wheel at any speed up to a certain limit but which cannot be actuated to increase the wheel speed beyond that limit unless the wheel has worn to a sufficiently small and predetermined size.

It is a further object to provide an electrical speed control device for a grinding machine of the type having a grinding wheel at each end of the wheel spindle, which is so arranged that the larger diameter wheel will determine the maximum speed of rotation.

Other objects will be apparent from the following disclosure. One embodiment of this invention has been illustrated in the accompanying drawings in which like reference numerals indicate like parts:

Fig. 1 is a rear elevation of a grinding wheel floor stand embodying this invention;

Fig. 2 is a fragmentary sectional view taken approximately on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken approximately on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary longitudinal sectional view on an enlarged scale taken approximately on the line 4—4 of Fig. 2; and

Fig. 5 is a fragmentary view partly broken away to show the operating mechanism taken approximately on the line 5—5 of Fig. 4.

In accordance with this invention, a motor driven grinding machine may be provided with a variable speed motor having an electrical speed control device, such as a rheostat, which is arranged to control the speed of the motor so that the peripheral speed of the grinding wheel may be varied to permit increasing the speed as the wheel wears away. Suitable mechanism is provided to limit adjustment of the rheostat so as to prevent increasing the speed of the grinding wheel until it has worn away to a predetermined size so that it may be run safely at an increased speed and for this purpose we preferably employ a stop member movable in the path of the control lever of the speed control device which prevents moving the control lever except as the stop is moved out of the way. This stop device is actuated by a contact member, such as a wheel guard, a tool rest or a spark shield, which is so arranged that its movement toward the periphery of the grinding wheel is limited by contact therewith, hence it can be moved to permit increasing the wheel speed only after the wheel has worn to a smaller diameter.

A grinding machine embodying the invention is illustrated in the drawings as having a base 11 rotatably supporting a grinding wheel spindle 12 in bearings 13 at either end thereof. A grinding wheel 14 is fixedly mounted on each end of the spindle 12 and is surrounded by suitable wheel guards 15 and 16. The spindle may be rotated by a suitable driving mechanism, such as a variable speed motor 18, which is preferably mounted within the base of the machine. A driving pulley 19 is mounted on the end of the motor shaft and it is connected by driving belts 20 with a pulley 21 which is keyed to the spindle 12 by a key 22. The speed of the motor may be controlled by a suitable rheostat 25, such as is shown in Figs. 4 and 5. This rheostat may comprise a suitable resistance element and a series of contact points 26 arranged to be contacted with by the rheostat control arm 27, the latter being revolubly mounted on a rotatable shaft 28. The rheostat is connected with the motor by suitable electrical wiring, indicated by the conduit 29, which is also connected to a suitable source of power.

To attain the main object of this invention a suitable mechanism is provided to prevent actuation of the rheostat to increase the speed of the motor until the grinding wheel has worn away to a predetermined size. This mechanism may comprise a movable contact member which is adjustable towards and from the periphery of the grinding wheel. As illustrated in the drawings, the contact member may comprise a wheel guard 15 which is slidably mounted on the ways 30 of the base 11. The wheel guard is provided with a flange 31 projecting from its side, and this flange has a surface engaging the way 30 on the base. A pinion 32 is rotatably mounted on the flange 31 and engages a rack bar 33 on the way 30 of the base. By rotating the pinion 32, the wheel guard may be adjusted so as to maintain it in proper relation with the periphery of the wheel. A spark shield 35 is provided projecting downwardly from the upper portion of each wheel guard. It is desirable in normal grinding operations to maintain the shield 35 in close proximity to the periphery of the grinding wheel.

An additional support is provided to steady the wheel guard 15 and permit it to be locked relative to the base 11. This support comprises a projection 36 on the base 11 which has a way engaging a correspondingly shaped projection 37 on the wheel guard 15. As the operator adjusts the position of the guard, the ways on members 36 and 37 serve to guide and support the wheel guard. To permit locking the guard relative to the base of the machine, an eye bolt 40 is mounted in a hole in the member 36 and passes through an elongated slot 41 in the member 37. The upper end of the eye bolt is provided with a nut 42 to permit adjustment of the length of the screw to produce the desired clamping action. A cam shaped member 43 is pivotally mounted to the eye bolt by means of a stud 44. The cam surface 43 coacts with the under surface of the projection 36 to draw downwardly on the bolt 40 and clamp the projection 37 in rigid engagement with the projection 36 of the base 11. For convenience of operation, the cam shaped member is provided with an actuating handle 45.

A suitable stop lug 50 is mounted on a plate 51 arranged to move in the path of a projection 52 which is rigidly mounted on the rheostat shaft 28. The plate 51 is pinned to the end of a shaft 55 which is supported in the bracket 56 at one end and a supporting bracket (not shown) at the other end which are fixed on the rear of the machine base. The latter bracket is similar to a bracket 57 which is shown supporting a control shaft 58 on the other end of the machine. The outer end of the shaft 55 is provided with a gear 59 meshing with a rack 60 which is fixed to the wheel guard 16.

It will be readily seen from this construction that any movement of the wheel guard 16 is transmitted through the rack 60 and the gear 59 to rock the shaft 55 and move the

stop lug 50. The stop lug 50 serves to limit the rotation of the projecting arm 52 on the rheostat shaft 28 to prevent increasing the speed of the motor and grinding wheel. When the operator adjusts the position of the wheel guard 16 as the wheel wears away to maintain the spark shield 35 in close proximity to the periphery of the grinding wheel 14, a corresponding movement is transmitted to reposition the stop lug 50 so that the rheostat control arm 27 may be advanced until the arm 52 again strikes the stop lug 50 thereby preventing further advance of the speed until the grinding wheel has worn away a further amount. Adjustment of the speed may be made periodically as the wheel guard is adjusted to compensate for wheel wear.

It is desirable, in a machine of this type, that the larger diameter grinding wheel shall control the rotative speed of the grinding wheel spindle so as to prevent the operator from advancing the speed beyond a predetermined safe speed. To accomplish this, the wheel guard 15 is adjustably mounted on the base of the machine similar to the guard 16. The guard 15 is provided with a projection 61 having a pinion 62 engaging a rack bar 63 on the base of the machine. A suitable supporting and clamping device 65 actuated by a lever arm 66 is provided to permit locking the guard 15 relative to the base 11. This supporting and clamping device is of the same construction as that shown in connection with wheel guard 16 and consequently has not been illustrated in detail. The wheel guard 15 is provided with a rack bar 68 meshing with a gear 69 on the outer end of the shaft 58. The inner end of the shaft 58 is supported in the bracket 70 which is fixed to the base 11. A stop lug 71 is mounted on a plate 72 which is pinned to the inner end of the shaft 58. It will be readily apparent from this construction that any movement of the guard 15 will be transmitted through the rack 68, gear 69, shaft 58 to rotate the plate 72 and thereby adjust the position of the lug 71. The lug 71 is arranged in the path of an arm 75 which is fixed to the rheostat shaft 28. When the guard 15 is adjusted after wheel wear, it repositions the stop lug 71 away from contact with arm 75. The rheostat control arm 27 may then be advanced until the arm 75 again contacts with the stop lug 71. No further advance of the speed is permitted until the grinding wheel has worn away a predetermined amount and the wheel guard 15 adjusted to compensate for wheel wear. When one of the grinding wheels wears away and its guard is adjusted, the corresponding stop lug connected with that particular wheel guard recedes from its corresponding arm on the rheostat shaft and it is necessary for both of these lugs to recede before the operator can adjust the rheostat to advance the speed of the motor.

A suitable hand wheel 80 is rotatably supported on a cylindrical portion 81 of the plate 72. This wheel is provided with a projecting pin 82 engaging a yoked member 83 on the arm 75 so that any rotary movement of the hand wheel 80 will transmit a corresponding movement through the pin 82 and the yoked member 83 and the arm 75 to turn the rheostat arm 27 and thereby increase the speed of the motor. The movement of the rheostat control arm 27 in a counterclockwise direction as viewed in Fig. 5 is limited by engagement of the arms 75 and 52 with the stop lugs 71 and 50 respectively. It will be readily apparent from this construction that advance of the rheostat control arm to increase the speed of the motor is prevented when the arm 75 or 52 strikes the stop lug 71 or 50. The operator may turn the rheostat control arm in the other direction to slow down the motor but cannot increase the speed further until the grinding wheels have worn away and the wheel guards readjusted to compensate for wheel wear which in turn repositions the stop lugs 71 and 50 so as to permit a further advance of the rheostat control arm.

The hand wheel 80 may be controlled manually if desired so that the operator after readjustment of the wheel guard may turn the hand wheel to reposition the rheostat and thereby obtain the maximum speed for a given diameter of grinding wheel. If desired, however, the hand wheel 80 may be turned automatically by a suitable means, such as a weight 90, which is secured at one end of a cord or chain 91 surrounding a groove 92 in the periphery of the wheel 80. The other end of the cord is suitably fastened to the pulley. The rheostat control arm 27 will be automatically advanced to increase the speed of the wheel by the pull of the weight turning the hand wheel 80 to maintain the arm 75 or 52 of the rheostat at all times in engagement with either one or both of the stop lugs 71 and 50.

The operation of this mechanism will be readily apparent from the foregoing disclosure. The grinding wheels are mounted on the opposed ends of the grinding wheel spindle 12 and the wheel guards 16 and 15 are adjusted so that the spark shields 35 are in close proximity to the grinding wheel periphery. The rheostat control wheel 80 is then turned either manually or automatically by the weight 90 until the control arm 27 is advanced so that the arms 75 and 52 contact with the stop lug 71 or 50. Grinding is resumed and the operator continues the grinding operation until the wheel wears away. At frequent intervals the operator adjusts the position of the wheel guards so as to maintain the spark shield 35 in close proximity to the grinding wheel periphery. This adjustment moves the stop lugs 71 and 50 away from contact with the arms 75 and 52 and

thereby permits the operator to either manually or automatically by means of the weight 90 increase the speed of the wheel and thereby maintain a substantially constant peripheral speed of the wheel as it wears away.

Having thus described the invention, what we claim as new and desire to secure by Letters Patent is:

1. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on said spindle, a variable speed motor to rotate the wheel, an electrical speed control device to regulate the rate of rotation of said wheel which includes a movable control member, a contact member movable relative to the wheel periphery and limited in its movement by contact therewith, and a stop device independently of and in the path of the control member and movable with the contact member, said parts being so arranged that the control member may be moved independently but may not be moved to increase the wheel speed above a predetermined limit until the wheel has worn away to a predetermined smaller size.

2. A grinding machine comprising a base, a wheel spindle rotatably mounted thereon, a grinding wheel on said spindle, a variable speed motor, a rheostat having a movable control member to regulate the rate of rotation of said wheel, a wheel guard movable relative to the wheel periphery and limited in its movement by contact therewith, and a stop device independent of and in the path of the control member and movable with the wheel guard, said parts being so arranged that the control member may be moved independently but may not be moved to increase the wheel speed above a predetermined limit until the wheel has worn away to a predetermined smaller size.

3. A grinding machine comprising a base, a wheel spindle, a grinding wheel thereon, a variable speed motor to rotate said wheel, a rheostat having a revoluble control member to regulate the speed of rotation of the wheel, a contact member movable relative to the wheel periphery and limited in its movement by contact therewith, a pivotally mounted stop movable independently of and revoluble in the path of the control member, and connections between said contact member and stop to swing said stop when the contact member is moved which is arranged to prevent increasing the wheel speed until the wheel has worn away to a predetermined but smaller size.

4. A grinding machine comprising a wheel spindle, a grinding wheel thereon, means including a variable speed motor to rotate the wheel, a rheostat having a revoluble control member to regulate the rotation of said wheel, a wheel guard movable relative to the wheel periphery and limited in its movement by contact therewith, a pivotally mounted stop movable independently of and revoluble in the path of the control member, and connections between said guard and stop to swing said stop when the contact member is moved which is arranged to prevent increasing the wheel speed until the wheel has worn away to a predetermined but smaller size.

5. A grinding machine comprising a wheel spindle, a grinding wheel thereon, means including a variable speed motor to rotate the spindle, a rheostat having a movable control member to regulate the rate of rotation of said spindle, a contact member movable relative to the wheel periphery and limited in its movement by contact therewith, a stop independent of and movable in the path of the control member, connections between said contact member and stop to move the stop when the contact member is adjusted, and means to adjust the rheostat control member into contact with the stop when the stop has been moved by the contact member.

6. A grinding machine comprising a base, a wheel spindle rotatably mounted thereon, a grinding wheel on said spindle, means including a variable speed motor to rotate the wheel, an electrical speed control device having a movable control member to regulate the rate of rotation of the wheel, a contact member movable relative to the wheel periphery and limited in its movement by contact therewith, a stop in the path of the control member, connections between said contact member and stop arranged to move the stop when the guard is moved, and automatic means to maintain said control member at all times in engagement with said stop to maintain a maximum safe speed of rotation of the grinding wheel as it wears away.

7. A grinding machine comprising a wheel spindle, a grinding wheel thereon, means including a variable speed motor to rotate the wheel, a rheostat having a movable control member to regulate the rate of rotation of the wheel, a wheel guard movable relative to the wheel periphery and limited in its movement by contact therewith, a pivotally mounted stop in the path of the control member, connections between said wheel guard and stop to swing the stop when the guard is moved, and automatic means to maintain said control member at all times in contact with said stop to maintain a maximum speed of rotation of the grinding wheel for its diameter.

8. A grinding machine having a base, a rotatable spindle mounted therein, a grinding wheel at each end of said spindle, means including a variable speed motor arranged to rotate said spindle, a rheostat having a revoluble control member to regulate the speed of rotation of said wheel, a wheel guard surrounding each of the grinding wheels which are independently movable relative to the wheel peripheries and limited

in its movement by contact therewith, and independent pivotally mounted stops operatively connected to the wheel guards and revoluble thereby in the path of the control members which are arranged so that each wheel guard may be adjusted independently and so that the larger diameter wheel will control the rotation of the grinding wheel spindle and thereby prevent excessive speed of either wheel.

Signed at Worcester, Massachusetts, this 28th day of June, 1929.

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